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Mr. Derek Robinson
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Subject: **SFDPH Comments on the Draft Parcel G Removal Site Evaluation Work Plan, Hunters Point Naval Shipyard, San Francisco, California, June 2018**

Dear Derek:

General Comments

1. It is hard to track the slightly scattered details in the plan regarding the radionuclides of concern (ROCs) and corresponding RGs that are applicable to individual areas and survey types. A number of specific comments regarding these possible inconsistencies have been included. Similarly, the plan also seems inconsistent regarding whether all samples will be analyzed for all ROCs or just subsets of samples for certain ROCs. It might help the reader to provide some clarification in summary tables?
2. In our professional judgement, the use U-238 as a proxy for Ra-226 may cause problems in your evaluation. We have found that this equilibrium is not consistent between U-238 and Ra-226 in real-world environmental samples. Additional detail on that issue is provided in the specific comments.

Specific Comments

3. **Executive Summary, Background, Page III, and Section 1, Introduction, Page 1-1:** The introduction paragraphs of the Executive Summary and Section 1 state "Radiological surveys and remediation were previously conducted at Hunters Point Naval Shipyard (HPNS) as part of a basewide Time-critical Removal Action (TCRA) in accordance with the Action Memorandum (Navy, 2006)." Please clarify this broad statement since radiological surveys and remediation activities were also performed at HPNS prior to 2006. For example, if true, the sentence could be clarified by inserting 'Parcel G': "Radiological surveys and remediation were previously conducted at Hunters Point Naval Shipyard (HPNS) [Parcel G] as part of a basewide Time-critical Removal Action (TCRA) in accordance with the Action Memorandum (Navy, 2006)." That way it is clear that Parcel G work was all done after 2006 (if true).
4. **Executive Summary, Soil Investigations, Page IV and Figure ES-1, Soil and Building Sites:** The text states that the approximate size and boundary of the TUs and SUs are shown on Figure ES-1. Please consider revising to state that the buildings and former buildings (of interest for this study) and the storm drain and sanitary sewer trench outlines are shown on Figure ES-1. Or

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consider deleting this sentence as TUs and SUs are not specifically identified on Figure ES-1. Or you could insert a Figure like 3-1 that does identify TUs and SUs?

5. **Section 2, Conceptual Site Model, last sentence of the second paragraph:** If the results were based on the 186 keV photopeak then, in our opinion, they were biased high in all cases from the presence of naturally-occurring U-235 and you could emphasize that point by striking the word "often".

6. **Section 2, Conceptual Site Model, Table 2-1, last section on uncertainties, fourth main bullet:** Please revise as follows to provide the important distinction that Navy activities "potentially" contributed: "... are present at HPNS because of global fallout..., in addition to **being potentially present due to** Navy activities".

7. **Table 2-1, Conceptual Site Model, Radionuclides of Concern for Parcel G (from Table 8-2 of HRA):** Table 2-1 identifies ROCs for interior surfaces at former Buildings 364 and/or 365 as ^{60}Co, ^{232}Th, ^{235}U, and ^{239}Pu. Given that these buildings have been demolished is the intention that these ROCs be investigated as part of the planned soil survey unit investigation or will (some of) these ROCs be excluded from the proposed analytical suite? Please explain reasoning for including or excluding select ROCs. Table 3-4 identifies the ROCs for the Former Buildings 317/364/365 Site as ^{137}Cs, ^{226}Ra, ^{90}Sr, ^{239}Pu (excluding ^{60}Co, ^{232}Th, and ^{235}U). If these are the only ROCs being tested then Table 2-1 might need to state that sites where buildings have since been demolished will only be investigated for the Table 3-4 radionuclides and not this full historical list of radionuclides that might have been in the buildings before demolition.

8. **Table 2-1, Conceptual Site Model, Uncertainties:**
    a. **Bullet 1, sub-bullet 3:** We note that the pipes were often reported as "crushed" or "disintegrated" and sent to the RSY pads along with soil. Therefore, it is unclear whether all pieces of pipelines were removed if they disintegrated and were indistinguishable from the soil. Although it might be difficult, is there a percent that can be attached to the report of "disintegrated" pipes so the sub-bullet can have that clarified?
    b. **Bullet 1, sub-bullet 7:** Can you clarify the implication that LLRW bins were tested by the Navy's independent waste broker at an offsite laboratory using 5-point composites, and only 3 out of 1,411 bins had results with ^{226}Ra above the RGs. Were these soils still disposed of as LLRW?

9. **Section 3.3, Remediation Goals:** Table 3-5 includes a soil RG for Pu-239 and the accompanying text states that "soil data will be compared to the RGs ..." Table 3-4 implies that Pu-239 is a ROC for just soils associated with specific building sites. Please clarify whether Pu-239 is considered a ROC for all soils, or just some soils.

10. **Section 3.3.1, Investigation Levels, second paragraph:** An investigation level should indicate when a measurement indicates activity that is encroaching upon or exceeds an applicable RG. Why would that vary with a survey unit classification?

11. **Section 3.3.1: Investigation Levels:** Please add some discussion somewhere in the work plan regarding compensatory measures that will be used to identify small areas of elevated activity or locations where biased samples should be collected for ROCs that cannot be detected via gamma scanning. The plan points out that the RG for Cs-137 is indistinguishable from the local background and cannot be detected as a contaminant because the scan techniques lack sufficient sensitivity. Sr-90 likewise cannot be detected by a gamma scan because it is a Beta-only emitter, however, when the Sr-90 is still contained within a metal housing the energy

travelling through the metal can sometimes emit a signal that is detectable by the gamma scan technology.

12. **Section 3.3.1, Investigation Levels, Page 3-3, and Section 3.6.3.1, Automated Soil Sorting System Process, page 3-14:** Section 3.3.1 states soil gamma scan survey measurement investigation levels are not applicable for ^{137}Cs based on a detection limit of less than 0.113 pCi/g (Residential Soil Remediation Goal (RG) prior to addition of background); however, Section 3.6.3.1 states that the large-volume gamma spectroscopy detectors proposed under the automated soil sorting system process *are capable* of monitoring ^{137}Cs. Are the automated soil sorting system detectors capable of detecting ^{137}Cs at the RG? If not, please clarify in the text the scanning capabilities.

13. **Section 3.4.4, Phase 1 Trench Unit Design, Page 3-5:** We note that segregated over-excavated material may ultimately be mixed with soil from the TU following testing upon return to the origin trench.

14. **Section 3.4.4.1, Nomenclature of Phase 1 Trench Units, Page 3-5:** Should the example for former TU-153 be "HPPG-SFU-153A" instead of "SFU-153A"?

15. **Section 3.5.1, Soil Gamma Scanning Instruments:** Will the isotope-specific Region of Interest data from the gamma scanners be available in real-time, or via post-processing? It seems unlikely that a scan measurement would have sufficient sensitivity for the Bi-214 peak or for Cs-137 at a concentration near the RG. Indeed, Section 3.1.1 states that the Cs-137 RG cannot be detected by scanning. How will scan data for those Region of Interest be interpreted or used?

16. **Section 3.6.3.2, Radiological Screening Yard Pad Process:** states excavated soil will be screened for compliance with the RGs given in Table 3-5. The ROCs in Table 3-5 include Sr-90 and Pu-239, in addition to Cs-137 and Ra-226. Elsewhere in the work plan it is stated that the ROCs for trench unit soils are limited to Sr-90, Cs-137, and Ra-226. Please clarify whether Pu-239 is considered a ROC for trench unit soils (presumably not), and the role of scanning with respect to showing compliance for Sr-90. Will all soil samples be analyzed for Sr-90 in addition to gamma spectrometry?

17. **Section 3.7, Radiological Laboratory Analysis:** This section of the plan states that only 10% of the samples will be analyzed for Sr-90, plus any that show Cs-137 at or above the RG. It also states that Pu-239 analyses will only be done if both Cs and Sr are found to be above their respective RGs. Elsewhere it is implied that all samples will be analyzed for all ROCs. It would be helpful if the plan did a better job specifying which RGs are applicable to which soils and how compliance with those concentrations is going to be demonstrated.

18. **Section 3.7, Radiological Laboratory Analysis:** Unless separate analyses are intended, clarify that the 21-day ingrowth is only germane for the Ra-226 analysis via gamma spectroscopy, but that analysis will also include concurrent quantification of Cs-137.

19. **Section 3.7, Radiological Laboratory Analysis, Page 3-21:** Please support the decreased frequency of analysis for the site-specific ROCs ^{90}Sr and ^{239}Pu.

20. **Table 4-2:** Can you clarify that the RG for structures for Th-232 is less than that for Pu-239?

21. **Section 4.5.7.2, Scan Investigation Levels:** If the SCM is to be used would it not make more sense to use the images from the SIMS output to identify areas where static measurements should be collected? It is recognized that data would not be available in real-time, but it can be produced in a reasonable amount of time and would be a more reliable indicator.

22. **Section 5, Data Evaluation and Reporting:** Where recorded, spatially-correlated data should also include modern visualizations and not just be limited to "dumbed-down" plots to match the antiquated methods described in the MARSSIM. Spatial visualizations provide much better sensitivity with respect to identifying artifacts.

23. **Section 5.3.1,** Identify Potential Areas of Elevated Activity, states "Any sample or measurement exceeding a ROC-specific RG will be investigated as an area of elevated activity." Elsewhere in the work plan it is stated that such exceedances will be deemed a non-conformance with the remedial action objectives rather than treated as an area warranting further investigation. This appears to be an inconsistency that needs to be reconciled.

24. **Section 5.4, NORM Background Evaluation:** Any sampling area that represents the background concentration will necessarily have individual results that exceed the average. Indeed, roughly 50% of them will. We think it is scientifically valid to compare the two data sets (reference area and the area under test) as distributions.

25. **Section 5.4, NORM Background Evaluation, first sentence of second paragraph:** We suggest strengthening the statement that the Ra-226 background varies all over the site with the fact the Ra-226 background varies all over the Bay Area and all over the United States. There are numerous examples of data that can be cited to further emphasize that point.

26. **Section 5.4, NORM Background Evaluation:** The statement that U-238 is an "acceptable representative" of uranium series decay progeny cannot be tacitly assumed. That is an oversimplification based in a textbook situation where equilibrium exists. Uranium series disequilibria are common in reality. Radium, thorium, and uranium have different solubilities, and their solubility or soil adhesion characteristics can vary with pH. Any loss of decay progeny through a process other than radioactive decay will break the equilibrium. Preferential depletion or enrichment of U-234 relative to U-238 in geological samples is a well-known phenomenon. Geologic studies showing Th-230 concentrations in excess of the corresponding U-234 concentrations are reported in the literature, as are cases of substantial enrichment of radium relative to the local uranium concentrations. Assuming equilibrium between Ra-226 and U-238 to determine whether or not a given Ra-226 assay represents background has not played out for samples we have reviewed. Indeed, we have seen data from verified clean import samples from the Half Moon Bay area (i.e. available in public documents) that showed Ra-226 concentrations that exceeded the uranium concentration by a wide margin. The samples we are referring to were analyzed via different analysis methods and involved disparate sample volumes so that may factor into the apparent non-equilibrium. In contrast, non-impacted soil samples collected from Treasure Island (i.e. available in public documents) have shown the opposite, i.e. uranium and thorium concentrations that were significantly higher than the corresponding Ra-226. At a minimum we urge that the proposed NORM analyses should include Th-230 and U-234, in addition to U-238 and Ra-226, for the same aliquant. That would at least provide a better indication if an equilibrium condition existed.

27. **Section 5.5, Reference Background Area Soil Data, Equation 5-1:** It seems there should be some evaluation of the median relative to the mean or other consideration of the shape of the underlying distribution before applying its median in this fashion.

28. **Section 7.1, Project Waste Descriptions:** Consider revising the first sentence to state that wastes generated "may" be radiological in nature instead of "will be." Or will wastes be deemed radiological by default, without verification?

29. **Appendix A, Soil Reference Background Area Work Plan:** Selecting additional offsite areas for sampling would go a long way toward demonstrating the variability in background. These additional characterizations would not be for the purpose of defining reference areas, but would serve to emphasize the range of local backgrounds and the fact the current RGs might fall within those ranges. The Bay Area was blessed with a remarkably low average background, but instead of using that as an advantage it sometimes has been turned into a detriment for this project when the true range of background variability was not always analyzed. We have reviewed two sets of samples collected from Half Moon Bay that provide a good example. The results showed very different Ra-226 concentrations, with the concentrations from the first set significantly exceeding those from the second. The first set of five samples averaged 1.65 pCi/g Ra-226. The second set, consisting of two composite samples, averaged 0.63 pCi/g, more than a factor of two less than the first set. That sort of variability is not unusual and should be accounted for in any radiological evaluations performed at HPNS.
30. **Appendix A, Soil Reference Background Area Work Plan:** We recommend including some brief discussion why a RBA was not identified for Parcel G, e.g. ground covering, not an impacted area, etc.
31. **Appendix A, Soil Reference Background Area Work Plan, DQOs Step 5:** If RBA data sets end up being combined that would seem to counter the argument that HPNS is comprised of materials from various origins. Will additional RBAs be identified if the initial data sets are found to be statistically indistinguishable?
32. **Appendix A, Section 3.1, Survey Design, third paragraph:** The samples from the offsite RBA location should also be analyzed for primordial isotopes and decay series in addition to fallout radioisotopes. Offsite areas should be a focal point to emphasize the variabilities that exist in natural radioelement concentrations. Any primordial series disequlibria observed in the offsite sample data should likewise be emphasized.
33. **Appendix A, Section 3.1, Survey Design, third paragraph:** An evaluation of the relative amounts of the uranium series isotopes U-238, U-234, Th-230, and Ra-226 for each RBA soil sample should be included in addition to the statistical evaluations described so that any departures from equilibrium conditions are identified and accounted for. These assays should be performed from the same or similar-sized aliquants to minimize biases.
34. **Appendix A Table 3-1** seems to contradict earlier statements that RBA soils will be analyzed for Sr-90, Cs-137, and Ra-226. The table implies that Pu-239 will also be included in those analyses.
35. **Appendix A Section 3.1, Survey Design:** If the isotopes and RGs listed in Table 3-2 do not apply globally to all soil units at HPNS then that needs to be discussed and clarified. The ROCs in Table 3-2 differ from those cited in the main body of the Parcel G work plan, which itself seems inconsistent regarding the applicable ROCs for various areas.
36. **Appendix A, Section 3.1.7, Laboratory Analysis:** Please confirm if all RBA samples are to receive all of the analyses listed in Table 3-6. If not, then the specific analyses intended for each sample needs to be documented in the SAP or the work plan or both.
37. **Appendix A, Section 4, Data Evaluation and Reporting:** The background data analyses and conclusions for each data set or combination of data sets should also address the observed degree of equilibrium (or magnitude of any disequilibria) for the important members of primordial series decay chains (e.g. U-238, U-234, Th-230, and Ra-226).

Minor Comments:

38. **Table 2-1, Conceptual Site Model, Site Location Section:** Typo "comer" should be "corner".

Sincerely,

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